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16. (New) The process according to Claim 12, wherein aerated aqueous suspension withdrawn from the aeration tank is ozonizated.

REMARKS

Acknowledgement is made of Claims 7-10 being drawn to an invention that was non-elected with traverse. Upon the allowance of the present application, Claims 7-10 will be canceled without prejudice to the filing of a divisional application thereon.

Due to the Board of Appeals' reversal of the Examiner's previous final rejection of the claims, the Examiner has instituted new rejections of the claims. Specifically speaking, Claims 11, 2 and 5 have been rejected under 35 USC 103(a) as being unpatentable over Smith et al in view of Hei et al or Berndt or Kramer et al. Claim 12 has been rejected under 35 USC 103 as being unpatentable over Smith et al in view of Hei et al or Berndt or Kramer et al and further in view of Dorau et al. Claim 3 has been rejected under 35 USC 103 as being unpatentable over Smith et al in view of Hei et al or Berndt or Kramer et al and further in view of Brock. Claim 4 has been rejected under 35 USC 103 as being unpatentable over Smith et al in view of Hei et al or Berndt or Kramer et al and further in view of Brock. Applicants respectfully traverse these grounds of rejection and urge reconsideration in light of the following comments.

Claims 13-16 have been newly added in order to further distinguish the claimed invention over the prior art cited by the Examiner. Claims 13 and 14 require that the amount of biosludge ozonized and converted into BOD components is greater than the amount of excess sludge generated in the bioreactor. Newly presented Claims 15 and 16 require that aerated aqueous suspension withdrawn from the aeration tank be ozonizated. No new matter has been added.

The present invention is directed to a process for the aerobic biological treatment of an aqueous organic waste. This process requires the aqueous organic waste to be introduced into an aeration tank where it is aerated in the presence of a biosludge composed essentially of aerobic microorganisms to form an aerated aqueous suspension, the aerated aqueous suspension withdrawn from the aeration tank and introduced into a solid/liquid separation unit where the aerated aqueous suspension is subjected to solid/liquid separation to form a separated sludge containing the biosludge and a separated liquid phase, the separated liquid phase withdrawn from the process as treated water, at least a portion of the separated sludge recycled back to the aeration tank, either aerated aqueous suspension withdrawn from the aeration tank or a part of the separated sludge ozonized at a pH of 5 or lower and either the ozonized aerated aqueous suspension or the ozonized part of the separated sludge recycled back to the aeration tank for aerobic biological treatment. A membrane separation unit can be used to perform the solid/liquid separation.

The inventive feature of the present invention resides in the reduction of the amount of excess sludge generated during an aerobic biological treatment process by using ozone to oxidatively reduce waste materials containing biosludge and the recycling of the oxidized waste material back into an aerator. That is, the present claims require that either a part of the separated sludge or aerated aqueous suspension withdrawn from the aeration tank be subjected to an ozone treatment at a pH of 5 or lower and that the ozonized aerated aqueous suspension or ozonized part of the separated sludge be recycled back to the aeration tank for further aerobic biological treatment. These steps enable the reduction of excess sludge generated in the aerobic biological treatment process. It is respectfully submitted that the prior art cited by the Examiner does not disclose such a process.

The newly cited Smith et al reference discloses a method for the treatment of sewage or other biodegradable waste materials and includes an aerobic process in which a settleable sludge is formed and a selected portion of the returned sludge is subjected to a microbial biolysis process. Although radiant energy is disclosed as being the preferred method of performing microbial biolysis, column 6, lines 55-61 state that other means for effecting biolysis such as electrolysis, ultrasonics, heat, low temperature, photochemistry, ozonization or other means which do not involve the production of toxic byproducts may be employed. Therefore, although this reference discloses that ozonization may be used to perform biolysis on separated sludge, this reference has no disclosure that anything advantageous would occur by using ozonization as opposed to the other means of effecting biolysis disclosed there or that any advantage would be gained by performing the ozonization at a pH of 5 or lower. Additionally, this reference has no disclosure of a step of ozonizating aerated aqueous suspension withdrawn from the aeration tank. Therefore, the secondary references cited by the Examiner must provide these teachings in order to present a proper showing of prima facie obviousness. It is respectfully submitted that the secondary references contain no such teachings.

Hei et al discloses the use of a potentiated aqueous ozone cleaning composition to remove contaminating soil from a surface. Apparently this reference has been cited by the Examiner for the disclosure at column 3, lines 38-53, regarding solubility and instability of ozone at various pH levels. The fact that ozone may be more unstable at higher pHs has no correlation at all with respect to the reaction efficiency of ozone at the presently claimed pH range during a process for aerobic biological treatment of an aqueous organic waste. Hei et al discloses that the decomposition of ozone is substantially enhanced as the pH increases past 6. As shown

in Figure 16 of the present application, the reaction efficiency at pH 6 is much lower than the claimed upper limit of pH 5. As such, given the unexpectedly high efficiency at the presently claimed pH range of no higher than 5, the Hei et al reference clearly does not teach the presently claimed invention.

The Berndt reference discloses a reactor/sterilizer for disinfecting contaminated medical and/or biological waste and methods thereof. The Berndt reference apparently has been cited for its disclosure at column 4, lines 48-60, that ozone is more stable and more soluble in an aqueous solution as the temperature of the solution is reduced and at a pH less than about 9. As with the previously discussed Hei et al reference, the Berndt reference has no disclosure that would lead one of ordinary skill in the art to suspect that ozone would have an increased reaction efficiency at the claimed pH range of no greater than 5 in the claimed process, as this reference only discloses that ozone in an aqueous solution is more stable at a pH of less than about 9. As such, Berndt adds nothing to the previously discussed references.

The Kramer et al reference is directed to glassy polymeric gas separation membranes and a process for producing these membranes. Apparently this reference was cited for its disclosure at column 41, lines 14-31, that when ozone is dissolved in water, it behaves chemically like ozone in the gaseous phase as long as the water is at a relatively acidic pH and that at a high pH, a pH greater than 10, ozone is very rapidly destroyed. Like the previously discussed secondary references, Kramer et al has no disclosure with respect to the claimed pH range of no greater than 5 in improving the reaction efficiency of ozone in the treatment of biological sludge. As such, Kramer et al adds nothing to the previously discussed references.

The Dorau et al reference cited by the Examiner discloses a process for the biological purification of sewage in which

the substances that are difficult to decompose biologically or are not biologically decomposable are separated and concentrated to form a concentrate and the concentrate is then treated physically and/or chemically and the treated or untreated concentrate subjected to a biological transformation. Alternatively, the concentrate can be separated from the sewage to be purified. In the embodiment of the Dorau et al reference illustrated in the drawing, sewage 1 is introduced into a bioreactor 3 for aerobic treatment and the aerobically treated sludge introduced into a membrane/ultrafilter 9 by a filter pump 8. In the membrane/ultrafilter 9, sludge is separated from filtrate and the sludge is either discarded from the system as excess sludge 13 or returned to the bioreactor 3 as sludge concentrate 12 (referred to as 9 in the figure). The filtrate or biologically purified sewage 11 or untreated sewage 14 are introduced into a filtrate basin 15/1 in which concentrating is carried out by supplying the sewage 16/1 to a membrane/nano-filtering device 19/1.

In stage 4 of Dorau et al, physical or chemical treatment of concentrates 29/1 and 29/2 are performed. It is to be noted that these concentrates are neither aqueous aerated suspension nor the sludge which is either removed from the system as excess sludge 13 or returned to the bioreactor as sludge concentrate 12 (9). In the reactor basin 31, the concentrates 29/1 and 29/2 can be subjected to chemical treatment, such as ozone treatment, and then reintroduced back into the bioreactor via charging pump 32. As stated previously, this reference does not show (1) the removal of a portion of an aerated aqueous suspension from the aeration tank, ozone treatment of the aerated aqueous suspension and the returning of the ozonized aerated aqueous suspension back to the aeration tank or (2) performing ozone treatment on part of the sludge formed from the subjection of the aerated aqueous suspension to solid/liquid separation and the returning of the

ozonized part of the concentrated sludge back to the aeration tank for further aerobic biological treatment.

Additionally, the present invention requires that the ozone-treatment of the sludge or aerated aqueous suspension be performed at a pH of 5 or lower. Dorau et al has no disclosure with respect to the pH range at which the contents of reactor basin 31 are subjected to ozone treatment. As shown in Figure 16 of the present application, when the pH is adjusted to be between 3 and 5 prior to the ozone treatment, a much lower amount of ozone is needed to accomplish the desired oxidation. This is clearly unexpected in light of the disclosure of Dorau et al and the other secondary references cited by the Examiner.

The Brock reference has been cited by the Examiner for the "well known effect of microorganisms on the pH". Applicants readily admit that microorganisms involved in fermentation are more likely to lower than to raise the pH of their environment. However, since the present invention is not dealing with anaerobic fermentation, Applicants are hard-pressed to see how this reference is relevant to the presently claimed invention.

As pointed out repeatedly above, the references cited by the Examiner do not disclose or suggest that any unexpected advantage would occur by performing the claimed ozonization process at a pH of no greater than 5. Figures 16 and 17 clearly show the advantages associated with the claimed ozonization pH conditions. At a pH of 6, twice as much ozone gas is required to provide sufficient transformation into BOD as required at a pH of 5. A fifty percent reduction in the amount of ozone needed to perform the process is clearly unexpected in light of the generic disclosures of the references cited by the Examiner and establishes the patentability of the presently claimed invention thereover. Furthermore, as pointed out before, Claims 15 and 16 require that the aerated aqueous suspension withdrawn from the

aeration tank be ozonizated. The references cited by the Examiner clearly have no such disclosure of such a step. Therefore, it is respectfully submitted that the presently claimed invention clearly is patentably distinguishable over the prior art cited by the Examiner and that once again the Board of Appeals would reverse the Examiner's rejection of the claims.

Reconsideration of the present application and the passing of it to issue is respectfully solicited.

Respectfully submitted,

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